Unit 7.2. MCQs Set 1

Results

#1. Q1. In comparing plant and animal cells, which statement is correct?

☐
(A). Both lack membrane-bound organelles
☐
(B). Only plant cells have mitochondria, animal cells do not
☐
(C). Plant cells contain a cell wall (cellulose), chloroplasts for photosynthesis, large central vacuole; animal cells typically lack these
☐
(D). Both contain chloroplasts by default

Plant cells have a rigid cell wall, chloroplasts for photosynthesis, and a large central vacuole, features that animal cells generally lack.

#2. Q2. Early experiments proving DNA as genetic material included:

☐
(A). Morgan’s fruit fly crosses
☐
(B). Griffith’s transformation experiment with Streptococcus pneumoniae, followed by Avery-MacLeod-McCarty and Hershey-Chase experiments
☐
(C). Meselson-Stahl experiment only
☐
(D). None

Griffith’s experiment showed the transforming principle, Avery-MacLeod-McCarty identified it as DNA, and Hershey-Chase confirmed DNA’s role in heredity.

#3. Q3. Chemistry of nucleic acids reveals each nucleotide has:

☐
(A). Amino acids, methyl groups, sulfate
☐
(B). A phosphate group, a sugar (ribose or deoxyribose), and a nitrogenous base
☐
(C). Only lipids

☐
(D). None

Each nucleotide is made up of a phosphate group, a sugar (ribose in RNA or deoxyribose in DNA), and a nitrogenous base.

#4. Q4. Chargaff's rule states that in DNA,

☐
(A). A = G always
☐
(B). A + T = C + G
☐
(C). %A = %T and %G = %C
☐
(D). None

Chargaff's rule shows that in double-stranded DNA, the amount of adenine equals thymine, and guanine equals cytosine.

#5. Q5. The Watson-Crick model of DNA proposed

☐
(A). A triple helix structure
☐
(B). A double-stranded helix with antiparallel strands, bases paired A-T and G-C
☐
(C). None
☐
(D). No hydrogen bonds

The Watson-Crick model describes a double helix with complementary base pairing and antiparallel strands.

#6. Q6. DNA can have different forms (A, B, Z). The "B-form" is

☐
(A). Most common physiological form, right-handed helix
☐
(B). Left-handed helix
☐
(C). None
☐
(D). Single-stranded in cells

B-DNA is the most common form found under physiological conditions; it is a right-handed helix.

#7. Q7. Types of RNA do not include

☐
(A). mRNA, tRNA, rRNA
☐
(B). siRNA, miRNA, snRNA
☐
(C). RBC doping
☐
(D). None

'RBC doping' is not a type of RNA; all others are recognized classes of RNA.

#8. Q8. Concept of a "gene" historically means

☐
(A). None

☐
(B). A unit of inheritance controlling a trait, eventually known as a DNA segment coding for a functional product
☐
(C). RBC doping
☐
(D). Infectious illusions

Historically, a gene is considered a unit of heredity that governs a trait, later identified as a DNA segment coding for a product.

#9. Q9. The difference between prokaryotic and eukaryotic genes typically is that

☐
(A). None
☐
(B). Eukaryotic genes often have introns, promoters/enhancers, while prokaryotic genes are mostly contiguous coding regions
☐
(C). RBC doping
☐
(D). Infectious illusions

Eukaryotic genes contain introns and complex regulatory elements, unlike most prokaryotic genes which are continuous.

#10. Q10. The “C-value paradox” addresses

☐
(A). None
☐
(B). The lack of correlation between organismal complexity and genome size
☐
(C). RBC doping
☐
(D). Infectious illusions

The C-value paradox refers to the observation that genome size does not consistently correlate with an organism’s complexity.

#11. Q11. Triplexes, quadruplexes, and aptamers refer to

☐
(A). None
☐
(B). Non-canonical DNA/RNA structures (e.g., triple-stranded DNA, G-quadruplexes, aptamer folding)
☐
(C). RBC doping
☐
(D). Infectious illusions

These terms denote unusual structural conformations in nucleic acids beyond the classical double helix.

#12. Q12. DNA replication: the semi-conservative model was confirmed by

☐
(A). Griffith’s transformation
☐
(B). Meselson-Stahl experiment
☐
(C). None
☐
(D). RBC doping

The Meselson-Stahl experiment demonstrated that each new DNA molecule consists of one old and one new strand, supporting the semi-conservative model.

#13. Q13. The “dispersive model” of replication was disproven because

☐
(A). None
☐
(B). Meselson-Stahl’s results showed a pattern consistent with semi-conservative replication
☐
(C). RBC doping
☐
(D). Infectious illusions

The experimental results did not support the dispersive model, but were in line with semi-conservative replication.

#14. Q14. DNA replicative enzymes do not include

☐
(A). Helicase
☐
(B). DNA polymerase
☐
(C). Min. synergy
☐
(D). DNA ligase

‘Min. synergy’ is not an enzyme; helicase, DNA polymerase, and DNA ligase are involved in replication.

#15. Q15. Mechanism of DNA replication in prokaryotes involves

☐
(A). None
☐
(B). A single origin of replication (OriC) with bidirectional replication forks
☐
(C). RBC doping
☐
(D). Infectious illusions

Prokaryotic chromosomes typically replicate from a single origin with bidirectional forks.

#16. Q16. Types of gene mutations: “base substitution” can be

☐
(A). Missense, nonsense, or silent
☐
(B). None
☐
(C). RBC doping
☐
(D). Infectious illusions

Base substitution mutations can result in a missense change (different amino acid), a nonsense mutation (stop codon), or a silent mutation (no amino acid change).

#17. Q17. Frameshift mutation arises from

☐
(A). None

☐
(B). Insertion or deletion of nucleotides not in multiples of three, causing a shift in the reading frame
☐
(C). RBC doping
☐
(D). Infectious illusions

Frameshift mutations disrupt the reading frame of the gene, potentially altering all downstream codons.

#18. Q18. DNA damage and repair mechanisms: “nucleotide excision repair” deals with

☐
(A). None
☐
(B). Removal of bulky lesions such as thymine dimers and replacement with correct nucleotides
☐
(C). RBC doping
☐
(D). Infectious illusions

Nucleotide excision repair specifically targets bulky, helix-distorting lesions in DNA.

#19. Q19. Gene expression in prokaryotes typically features

☐
(A). None
☐
(B). Polycistronic mRNA, a single RNA polymerase, and no introns
☐
(C). RBC doping
☐
(D). Infectious illusions

Prokaryotic genes are usually organized in operons and transcribed into polycistronic mRNA without introns.

#20. Q20. The structure of a typical prokaryotic gene includes

☐
(A). None
☐
(B). A promoter (with –35 and –10 regions), an operator or regulatory sequence, and a continuous coding region
☐
(C). RBC doping
☐
(D). Infectious illusions

Prokaryotic genes are generally uninterrupted and are regulated by nearby promoter and operator sequences.

#21. Q21. Prokaryotic RNA polymerase has subunits

☐
(A). None
☐
(B). α_2, β, β’, and σ factor for initiation
☐
(C). RBC doping
☐
(D). Infectious illusions

The core enzyme is composed of α, β, and β’ subunits and the σ factor is necessary for promoter recognition during initiation.

#22. Q22. Mechanism of gene transcription includes

☐
(A). None
☐
(B). Initiation at the promoter, elongation (5’→3’ synthesis), and termination at specific signals
☐
(C). RBC doping
☐
(D). Infectious illusions

Transcription proceeds in three phases: initiation, elongation, and termination.

#23. Q23. Translation: the genetic code

☐
(A). None
☐
(B). Is read in triplets (codons), each specifying an amino acid or a stop signal
☐
(C). RBC doping
☐
(D). Infectious illusions

The genetic code is read in codons, where each triplet corresponds to a specific amino acid or a termination signal.

#24. Q24. Gene structure in eukaryotes typically

☐
(A). None
☐
(B). Consists of exons and introns with promoter elements like the TATA box, requiring splicing of pre-mRNA
☐
(C). RBC doping
☐
(D). Infectious illusions

Eukaryotic genes contain introns and exons; introns are removed during RNA splicing to form mature mRNA.

#25. Q25. RNA polymerases in eukaryotes:

☐
(A). None
☐
(B). RNA Pol I synthesizes rRNA, RNA Pol II synthesizes mRNA, and RNA Pol III synthesizes tRNA (and some rRNA)
☐
(C). RBC doping
☐
(D). Infectious illusions

Eukaryotic cells use three distinct RNA polymerases with specific roles in RNA synthesis.

#26. Q26. Post-transcriptional modifications in eukaryotes include

☐
(A). None
☐
(B). Addition of a 5’ cap, addition of a 3’ poly-A tail, and splicing of pre-mRNA
☐
(C). RBC doping
☐
(D). Infectious illusions

Eukaryotic pre-mRNA undergoes several modifications before translation, including capping, polyadenylation, and splicing.

#27. Q27. The Operon concept (e.g., lac operon) in prokaryotes exemplifies

☐
(A). None
☐
(B). A cluster of genes under a single promoter that is regulated collectively by a repressor or activator
☐
(C). RBC doping
☐
(D). Infectious illusions

The lac operon is a classic model of gene regulation in prokaryotes, where multiple genes are co-regulated.

#28. Q28. Basic concepts of Genetic Engineering might involve

☐
(A). None
☐
(B). Recombinant DNA technology, use of plasmids, restriction enzymes, DNA ligase, and transformation techniques
☐
(C). RBC doping
☐
(D). Infectious illusions

Genetic engineering relies on tools like restriction enzymes and vectors to manipulate DNA.

#29. Q29. Restriction enzymes in molecular biology are

☐
(A). None
☐
(B). Enzymes that cut DNA at specific palindromic sequences
☐
(C). RBC doping
☐
(D). Infectious illusions

Restriction enzymes cleave DNA at defined sequences, typically palindromic regions.

#30. Q30. DNA ligase

☐
(A). None
☐
(B). Joins Okazaki fragments during replication and seals nicks in recombinant DNA molecules
☐
(C). RBC doping
☐
(D). Infectious illusions

DNA ligase forms phosphodiester bonds between adjacent DNA fragments during replication and in recombinant DNA constructs.

#31. Q31. Plasmid vectors generally contain

☐
(A). None
☐
(B). An origin of replication, a selectable marker, and a multiple cloning site

☐
(C). RBC doping
☐
(D). Infectious illusions

Plasmid vectors are engineered to include essential elements for replication and selection within host cells.

#32. Q32. Transformation in cloning means

☐
(A). None
☐
(B). The introduction of a recombinant plasmid into bacteria, which then become transformants
☐
(C). RBC doping
☐
(D). Infectious illusions

Transformation is the process where competent bacterial cells take up recombinant plasmid DNA.

#33. Q33. Early evidence for DNA as genetic material: Avery, MacLeod, and McCarty showed

☐
(A). None
☐
(B). DNA from virulent bacteria could transform non-virulent strains
☐
(C). RBC doping
☐
(D). Infectious illusions

Their experiments demonstrated that DNA, not protein, was responsible for transforming bacterial phenotypes.

#34. Q34. Hershey-Chase used radioisotopes

☐
(A). None
☐
(B). 32P labeled DNA and 35S labeled protein; only the 32P label entered bacterial cells, proving DNA is the hereditary material
☐
(C). RBC doping
☐
(D). Infectious illusions

The Hershey-Chase experiment confirmed that DNA is the genetic material as only the radiolabeled DNA entered the bacterial cells.

#35. Q35. Nucleic acids' "phosphodiester bond" is between

☐
(A). None
☐
(B). The 3'-OH of one sugar and the 5'-phosphate of the next nucleotide
☐
(C). RBC doping
☐
(D). Infectious illusions

The phosphodiester bond connects the 3' hydroxyl group of one nucleotide to the 5' phosphate group of the next, forming the backbone of DNA and RNA.

#36. Q36. The “semi-discontinuous” replication in eukaryotes refers to

☐
(A). None
☐
(B). Continuous synthesis of the leading strand and discontinuous synthesis (Okazaki fragments) of the lagging strand
☐
(C). RBC doping
☐
(D). Infectious illusions

During replication, the leading strand is made continuously while the lagging strand is synthesized in short segments.

#37. Q37. Proofreading during DNA replication is mainly performed by

☐
(A). None
☐
(B). The 3’→5’ exonuclease activity of DNA polymerase
☐
(C). RBC doping
☐
(D). Infectious illusions

DNA polymerase’s 3’→5’ exonuclease activity removes misincorporated nucleotides during replication.

#38. Q38. DNA mismatch repair system fixes

☐
(A). None
☐
(B). Base-base mismatches left after replication if proofreading fails
☐
(C). RBC doping
☐
(D). Infectious illusions

The mismatch repair system identifies and corrects errors that escape the proofreading activity of DNA polymerase.

#39. Q39. Transcription in eukaryotes vs. prokaryotes differs because eukaryotes

☐
(A). None
☐
(B). Have three nuclear RNA polymerases and extensive post-transcriptional modifications such as splicing, 5’ capping, and 3’ polyadenylation
☐
(C). RBC doping
☐
(D). Infectious illusions

Eukaryotic transcription is more complex due to the presence of multiple RNA polymerases and mRNA processing events.

#40. Q40. Translation in prokaryotes can initiate even before transcription ends because

☐
(A). None
☐
(B). They lack a nuclear membrane, allowing transcription and translation to be coupled
☐
(C). RBC doping
☐

(D). Infectious illusions

In prokaryotes, the absence of a nuclear envelope permits simultaneous transcription and translation.

#41. Q41. The genetic code is “degenerate” meaning

☐
(A). None
☐
(B). Multiple codons can encode the same amino acid
☐
(C). RBC doping
☐
(D). Infectious illusions

Degeneracy of the genetic code means that there is redundancy, with several codons capable of coding for the same amino acid.

#42. Q42. Post-transcriptional modifications in eukaryotes do not include

☐
(A). None
☐
(B). 5’ capping
☐
(C). 3’ poly-A tail
☐
(D). Removal of exons
☐
(D)
☐
Exons are retained in the mature mRNA; instead, introns are removed during RNA processing.
☐
☐
☐
☐

#43. Q43. The lac operon is induced in E. coli when

☐
(A). None
☐
(B). Lactose is present, binding to the repressor and permitting transcription of the lac genes
☐
(C). RBC doping
☐
(D). Infectious illusions

When lactose is available, it binds to the lac repressor, lifting repression and allowing the operon to be transcribed.

#44. Q44. Basic concept in Genetic Engineering: “Cloning vector” must have

☐
(A). None
☐
(B). An origin of replication, a selectable marker, and a unique multiple cloning site (MCS)
☐
(C). RBC doping
☐
(D). Infectious illusions

A cloning vector requires these elements to successfully propagate and select for inserted DNA in host cells.

#45. Q45. “Competent cells” are

☐
(A). None
☐
(B). Bacterial cells that have been treated (e.g., with $CaCl_2$) or electroporated to enable DNA uptake
☐
(C). RBC doping
☐
(D). Infectious illusions

Competent cells are prepared to be permeable to DNA, facilitating the transformation process.

#46. Q46. Restriction-fragment length polymorphism (RFLP) analysis:

☐
(A). None
☐
(B). Variation in DNA sequences causes differences in restriction enzyme cutting patterns, used for genetic mapping or forensic analysis
☐
(C). RBC doping
☐
(D). Infectious illusions

RFLP analysis relies on variable fragment lengths due to differences in DNA sequence and restriction enzyme recognition sites.

#47. Q47. PCR (Polymerase Chain Reaction) key steps are

☐
(A). None
☐
(B). Denaturation, annealing, and extension
☐
(C). RBC doping
☐
(D). Infectious illusions

PCR amplifies DNA by cycling through denaturation, annealing of primers, and extension by DNA polymerase.

#48. Q48. Southern blot is used to

☐
(A). None
☐
(B). Detect specific DNA fragments after gel electrophoresis by hybridizing with a labeled probe
☐
(C). RBC doping
☐
(D). Infectious illusions

Southern blotting involves transferring separated DNA fragments to a membrane and hybridizing with a specific probe to detect a target sequence.

#49. Q49. Gene expression regulation in eukaryotes can occur at

☐
(A). None
☐
(B). Multiple levels such as transcription initiation, RNA processing, mRNA transport/stability, translation, and post-

translational modifications
☐
(C). RBC doping
☐
(D). Infectious illusions

Eukaryotic gene expression is highly regulated at several steps from transcription to translation and post-translational modification.

#50. Q50. Biotechnology example: producing insulin by

☐
(A). None
☐
(B). Cloning the human insulin gene into a bacterial expression system and purifying recombinant insulin
☐
(C). RBC doping
☐
(D). Infectious illusions

Recombinant insulin is produced by inserting the human insulin gene into bacteria (or yeast), expressing the protein, and purifying it.

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